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PROGRAM AND ABSTRACTS OF THE NINETEENTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF PARASITOLOGISTS

CLEVELAND, OHIO

SEPTEMBER 11 and 12, 1944

PROGRAM[1]

MONDAY MORNING SESSION, SEPTEMBER 11, 9:00 A. M.; ROOM 23, CHEMISTRY BUILDING, WESTERN RESERVE UNIVERSITY.

Read

1. Effects of Various Sulpha Drugs on the Protozoan Parasite *Eimeria tenella.* (15 min) (Lantern) CHARLES A. RIPSOM, University of Wisconsin.

2. Sulfamethazine in the Treatment of *Eimeria tenella* Infections in Poultry. (10 min) (Lantern) PHILIP A. HAWKINS, Michigan State College.

3. The Effect of Some Aryl Arsonic Acids on Experimental Coccidiosis Infection in Chickens. (15 min) (Lantern) NEAL F. MOREHOUSE AND ORLEY J. MAYFIELD, Dr. Salsbury's Laboratories, Charles City, Iowa.

4. Experimental Studies on the Life Cycle of *Eimeria bovis* in Calves. (15 min) (Lantern) DATUS M. HAMMOND, LEONARD REID DAVIS, GEORGE W. BOWMAN AND BENNETT T. SIMMS, United States Bureau of Animal Industry.

5. Physiological Responses of *Neoechinorhynchus emydis* (Acanthocephala) to Various Solutions. (15 min) HARLEY J. VAN CLEAVE AND ELIZABETH L. Ross, University of Illinois.

6. Further Notes on *Chabertia ovina.* (15 min) (Lantern) W. L. THRELKELD, Virginia Agricultural Experiment Station.

7. Studies on a New Xiphidiocercaria of the Virgula Type with Notes on the Life History. (10 min) (Lantern) PHILIP G. SEITNER, Purdue University.

8. Motion Picture of *Cercaria clausii* Monticelli, a Marine Rattenkönig Larval Trematode from the West Coast of Florida. (5 min) (Motion picture) R. M. CABLE, Purdue University, AND RICHARD A. MCLEAN, Academy of Natural Sciences of Philadelphia.

9. *Histoplasma capsulatum,* Its Biochemical and Immunological Properties. (15 min) GEORGE J. SCHEFF, Ohio State University.

10. The Incidence of Intestinal Protozoa in Mental Patients and in Cases Showing Symphtoms of Amoebic Dysentery. (15 min) VIOLA M. YOUNG, Chicago Medical School and the Chicago Free Dispensary.

[1] An alphabetical author index will be found at the end of this program. Extra copies of this Supplement, and portraits of parasitologists, will be on sale at the meeting.

11. On the Staining of Protozoa in Human Blood and Feces. (15 min) OSCAR FELSENFELD, Chicago Medical School and the Chicago Free Dispensary.

12. The Occurrence of the Pentastomid, *Porocephalus crotali* Humbolt, in Rattlesnakes of Southwestern Oklahoma. J. TEAGUE SELF, University of Oklahoma.

By Title

13. Paramphistomes of North American Domestic Ruminants. EMMETT W. PRICE AND ALLEN MCINTOSH, United States Bureau of Animal Industry.

14. Trypanosomes in North American Amphibians. Ross F. NIGRELLI, New York Zoological Society.

15. A Blood Parasite of the Turkey. E. MCNEIL AND W. R. HINSHAW, University of California.

16. The Continuous Culture of Pure Clones of *Dero limosa* Infected with *Adelina deronis*. THEODORE S. HAUSCHKA, Lankenau Hospital Research Institute.

17. A Case of *Trichostrongylus* sp. with Notes on the Identification of Ova. H. TSUCHIYA AND HELEN RELLER, Washington University (St. Louis, Mo.).

18. The Production of Anemia in Lambs by Hookworms, *Bunostomum trigonocephalum*. JOHN T. LUCKER AND ELEANOR M. NEUMAYER, United States Bureau of Animal Industry.

MONDAY AFTERNOON SESSION, SEPTEMBER 11, 2:00 P. M.; ROOM 23, CHEMISTRY BUILDING, WESTERN RESERVE UNIVERSITY.

Read

19. Comparative Growth Rates of Amoebae and Bacteria in Cultures of *Endamoeba histolytica* and Organism *t*. (15 min) (Lantern) CHARLES W. REES AND LUCY V. REARDON, National Institute of Health.

20. Inoculations of *Trichomonas foetus* (Protozoa) in Heifers. (15 min) (Lantern) BANNER BILL MORGAN, University of Wisconsin.

21. The Action of Negro and White Sera on Infective Hookworm (*Necator americanus*) Larvae. (15 min) Lantern) GILBERT F. OTTO, EVELYN ALLEN AND STERLING BRACKETT, Johns Hopkins University.

22. Tests to Determine the Ability of Species of Domestic Mosquitoes to Transmit *Wuchereria bancrofti*. (10 min) WALTER L. NEWTON AND WILLARD H. WRIGHT, National Institute of Health.

23. Agglutination of Microfilariae from *Litomosoides carinii* of the Cotton Rat by Normal Serums of Man and Other Animals. (15 min) (Lantern) JAMES T. CULBERTSON AND HARRY M. ROSE, Columbia University.

24. Cross Reactions between Polysaccharides from Various Animal Parasites (15 min) JOSÉ OLIVER-GONZÁLEZ, School of Tropical Medicine, Puerto Rico.

25. The Effects of Host Starvation on Worm Elimination and Glycogen Depletion with the Nematode *Ascaridia galli*. (10 min) (Lantern) W. MALCOLM REID, Monmouth College.

26. Substitution of Soybean Oil Meal for Animal Protein in Developing Resistance of Animals to Parasitism. (10 min) (Lantern) J. E. ACKERT, DOROTHY S. BRANSON, D. J. AMEEL, AND B. B. RIEDEL, Kansas State College.

27. Studies on Effects of Helminths on Growing Chickens. (10 min) (Lantern) J. E. Ackert and C. L. Wisseman, Jr., Kansas State College.

28. The Effects of Nematode Infections During the Prepatent Period on the Calf. (15 min) Roy L. Mayhew, Louisiana State University.

29. Alcoholism in Mice and its Effect on Natural and Acquired Resistance to *Hymenolepis nana* var. *fraterna*. (15 min) John E. Larsh, Jr., University of North Carolina.

30. Critical Tests with a Hexachloroethane-bentonite-water Suspension as a Fasciolicide in Cattle. (15 min) O. Wilford Olsen, U. S. Bureau of Animal Industry.

31. Common Names of Helminths. (15 min) Donald B. McMullen, University of Oklahoma; H. L. Van Volkenberg, Texas Agricultural and Mechanical College; and Paul D. Harwood, Drs. Hess and Clark Laboratories, Inc., Ashland, Ohio.

By Title

32. A Reaction of Rat Serum to Embryonated Eggs of *Trichosomoides crassicauda*. Vivian S. Smith, University of Illinois.

33. Studies on the Relationship of *Trichosomoides crassicauda* Infection in Rats to Mucoid Calculi of the Urinary Bladder. Vivian S. Smith, University of Illinois.

34. The Possibility of Eliminating the Schistosome Snail, *Australorbis glabratus*, from Canals by Controls of Water Flow. George W. Luttermoser, Oficina Cooperativa Inter-Americana de Salud Publica (Venezuela).

35. The Parasites of the Plethodontidae (Amphibia–Caudata) III. Arthur C. Walton, Knox College.

36. The Parasites of the Plethodontidae (Amphibia–Caudata) IV. Arthur C. Walton, Knox College.

37. The Parasites of the Proteidae and the Sirenidae (Amphibia–Caudata). Arthur C. Walton, Knox College.

38. Effect of Skim Milk on Infections of Ascarids, Whipworms, and Nodular Worms in Swine. L. A. Spindler and Harry E. Zimmerman, Jr., United States Bureau of Animal Industry.

39. An *in vitro* Method for the Bio-assay of Chemotherapeutic Agents in Filariasis. Harry M. Rose, James T. Culbertson and Eleanora Molloy, Columbia University.

Tuesday, September 12.

1:00 P.M. Parasitologists' Luncheon.

2:30 P.M. Presidential Address.

40. The Trombiculid Mites (Chigger Mites) and Their Relation to Disease. Henry E. Ewing, United States Bureau of Entomology and Plant Quarantine.

3:00 P.M. Annual Business Meeting.

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SYMPOSIUM ON PARASITOLOGY IN RELATION TO THE WAR

Organized in Cooperation with Section N (Medical Sciences) of the A.A.A.S., the Amerian Society of Zoologists, and the American Society of Tropical Medicine.

CLEVELAND, OHIO

TUESDAY MORNING, 9:30 A.M., SEPTEMBER 12, 1944, THE AUDITORIUM, ACADEMY OF MEDICINE.

PROGRAM

1. The Wartime Importance of Tropical Diseases. JAMES S. SIMMONS, Brig. General, Medical Corps, U. S. Army.
2. Malaria and The War. O. R. McCOY, Major, Medical Corps, U. S. Army.
3. The Development of Malarial Sporozoites in the Vertebrate Host. CLAY G. HUFF AND FREDERICK COULSTON, University of Chicago.
4. The Present Status of the Filariasis Problem. H. W. BROWN, Columbia University.
5. Distribution and Control of the Fevers of the Typhus group. R. E. DYER, National Institute of Health.
6. Development of Louse Powders for the Armed Forces. W. E. DOVE, U. S. Bureau of Entomology and Plant Quarantine.
7. Parasites in Relation to Production of Meat and Other Animal Products in Wartime. BENJAMIN SCHWARTZ, U. S. Bureau of Animal Industry.

ABSTRACTS

AMERICAN SOCIETY OF PARASITOLOGISTS' PROGRAM

1. *Effects of Various Sulpha Drugs on the Protozoan Parasite,* Eimeria tenella. CHARLES A. RIPSOM, University of Wisconsin.

Various sulpha drugs have been used to determine their effect on the protozoan parasite, *Eimeria tenella,* causing caecal coccidiosis in chickens. Tests carried out so far demonstrate that sulphadiazine will not only prevent development of the asexual stages of the parasite but will also prevent the development of the sexual stage. This compound has been found effective when given in single doses or when administered in the feed.

2. *Sulfamethazine in the Treatment of* Eimeria tenella *Infections in Poultry.* PHILIP A. HAWKINS, Michigan State College.

Four-week-old chicks infected with *Eimeria tenella* were treated with sulfamethazine at the first appearance of blood in the droppings. The drug was administered to one group of twenty birds as a saturated solution, to a similar group as 1 per cent of the feed. The mortality of the untreated controls was 78 per cent, of those receiving the drug in the water 70 per cent, and of those receiving it in the feed 10 per cent. The average sulfamethazine level in the blood of birds dying while receiving the drug in water and feed was 1.2 mg per cent and 0.5 mg per cent, respectively. The blood levels of the same groups surviving the infection were 3.2 mg per cent and 16.3 mg per cent for a four-day period after treatment started. Similar groups of uninfected birds given sulfamethazine in the water and feed had blood levels of 4.4 mg per cent and 20.2 mg per cent, respectively. Infected birds will continue to eat longer than they will drink, while some groups of infected birds will drink more than others. This probably explains the discrepancy between these results and those previously reported by the writer (1943, Poultry Sci. **22**: 459).

3. *The Effect of Some Aryl Arsonic Acids on Experimental Coccidiosis Infection in Chickens.* NEAL F. MOREHOUSE AND ORLEY J. MAYFIELD, Dr. Salsbury's Laboratories, Charles City, Iowa.

The aryl arsonic acids 4-hydroxy phenylarsonic acid, 3-nitro 4-hydroxy phenylarsonic acid and their sodium salts, when given at relatively non-toxic doses prior to infection, have repeatedly reduced or completely eliminated hemorrhage and mortality in test groups of chickens infected with the coccidium *Eimeria tenella.* A preparation containing sodium 4-hydroxy phenylarsonate, sodium and ammonium phenolsulphonates, boric acid and lactose has shown high efficacy when the concentration of the arsenic compound in water was 0.0269 per cent. In three experiments using 252 treated chicks and 252 controls, the mortality from cecal coccidiosis was 2 and 83 respectively. Similar results have been obtained with phenolsulphonate-lactose-boric acid preparations containing 3-nitro 4-hydroxy phenylarsonic acid where the concentration of the arsenic compound in the water was much lower than was necessary when 4-hydroxy phenylarsonic acid was used. When the concentration of 3-nitro 4-hydroxy phenylarsonic acid in such preparations was approximately 0.00256 per cent in the water, marked growth-stimulating properties were noted. In numerous experiments statistical analyses have shown highly significant differences between the mean gains of treated and control chicks.

4. *Experimental Studies on the Life Cycle of* Eimeria bovis *in Calves.* DATUS M. HAMMOND, LEONARD REID DAVIS, GEORGE W. BOWMAN AND BENNETT T. SIMMS, U. S. Bureau of Animal Industry.

Small numbers of sporozoites were found in the lower small intestine of a 3-day-old calf killed 18 hours after inoculation with oöcysts of *Eimeria bovis* (syn. *E. smithi*). Some excystation occurred in oöcysts incubated for 24 hours in filtered intestinal contents, while oöcysts excysted partially in a cellophane bag placed for 18 to 46 hours in a Thiry fistula in a calf. The first stage found was identified as a schizont. Schizonts occurred chiefly in the lower small intestine. Each schizont was typically located at or near the center of a villus, in a host cell encapsulated by fibroblasts. The schizonts were found as early as five days after inoculation, but numerous schizonts were not found until 11 days after inoculation. The smallest schizont found measured 9.1 microns in greatest diameter; at maturity, beginning about 14 days after inoculation, the schizonts reached a maximum size of 450 microns, and contained thousands of merozoites. The number of generations has not been determined. That the merozoites may give rise to the sexual stages was shown in two trials, which resulted in the recovery of *E. bovis* öocysts from the Thiry fistula, 5, and 4 to 16 days, respectively, after injection of schizonts and merozoites obtained from the intestine of calves 23 and 17 days, respectively, following inoculation of oöcysts. The sexual stages occur in the intestinal glands, usually only in the cecum and colon. The development of the macrogametocyte, microgametocyte, and oöcysts was observed.

5. *Physiological Responses of* Neoechinorhynchus emydis (*Acanthocephala*) *to Various Solutions.* Harley J. Van Cleave and Elizabeth L. Ross, University of Illinois.

Except for gravid females, bodies of living *Neochinorhynchus emydis* in intestine of turtle hosts are normally flat and wrinkled. Subjection to the usual saline solutions for examination and routine preservation render them turgidly cylindrical. Since all metabolic materials must pass through the body wall, maintenance of normal permeability is extremely important.

Removed to water, swelling was conspicuous in one hour and death followed in a few hours. In 0.5 per cent sodium chloride with 0.02 per cent calcium chloride (Gettier, 1942) turgidity was delayed until the third or fourth day; worms lived 10 to 12 days *in vitro.* Only sample experiments are here cited; condition of worms and host are uncontrolled factors.

In 0.7 and 0.75 per cent sodium chloride, worms remained flat 4 days; survived about 10 and 12 days respectively. In 0.8 per cent sodium chloride, worms remained flat the full 10 days of survival. In 0.85 per cent, they became excessively wrinkled; lived 15 days; turgidity was postponed until thirteenth day.

After 1 hour in water, turgid worms transferred to 0.85 per cent sodium chloride resumed flattened condition in 5 hours; lived 5 to 8 days.

Solutions were administered by mouth to living turtles. One hour after injecting water, autopsy revealed highly turgid worms attached in intestine. 0.8 per cent sodium chloride, 4½ hours after introduction, yielded worms normally flattened, wrinkled. Removed to same solution in vitro, worms lived 10 days.

6. *Further Notes on* Chabertia ovina. W. L. Threlkeld, Virginia Agricultural Experiment Station.

A study is being made on *Chabertia ovina,* the large-mouthed bowel worm of sheep, in an effort to clarify its status in relation to its host animal. Two phases are at present considered. First, a preliminary study of a possible hemolytic factor, together with a detailed examination of the cephalic, cervical, and other anatomical structures in the parasite indicate further tests should be pursued. A table showing positive results from the action of the possible hemolytic factor against defibrinated sheep blood is presented, as well as photomicrographs illustrating an analysis of the structures which may be involved. The second phase involves observations made on lambs experimentally infested with pure cultures of the infective larvae of *Chabertia ovina.* Typical symptoms of parasitization have been established in two lambs. The records of these animals show loss of weight, profuse bloody diarrhea, and a significant drop in hemoglobin and erythrocytes.

7. *Studies on a New Xiphidiocercaria of the Virgula Type with Notes on the Life History.* Philip G. Seitner, Purdue University.

As many as 30 per cent of the specimens of *Goniobasis depygis* collected from McCormick's Creek, Indiana, have been found to harbor a new stylet cercaria of the Virgula type. The larvae penetrate and encyst in mayfly naiads, becoming metacercariae identical with those occurring in naturally infected naiads from the same locality. The adult stage possibly may be *Loxogenes bicolor* which has been recovered from frogs collected from the stream; metacercariae show unmistakable adult lecithodendriid characters which correspond closely to those of *L. bicolor.* Feeding experiments are in progress. Measurements in mm of 10 cercariae killed in hot 10 per cent formalin: body length 0.137–0.167 (average 0.15), width 0.045–0.06 (0.053); tail length 0.068–0.091 (0.08), width near base 0.016–0.018 (0.017); length of oral sucker 0.04–0.05 (0.045), width 0.038–0.04 (0.039); ventral sucker 0.018–0.019 in diameter; stylet length 0.018–0.02 (0.019); diameter of pharynx 0.01. Entire body spinose, cuticle thick and with several hair-like processes near mouth; ventral sucker at beginning of posterior body half; tail simple, aspinose. Three pairs of cephalic glands behind anterior margin of ventral sucker; posterior pair granular; ducts in a single bundle on each side. Virgula organ large, trilobed in appearance when flattened; intestine undeveloped. Excretory vesicle U-shaped, surrounded by granular cells; main excretory tubules extend anterolaterad from arms of vesicle, dividing at level of ventral sucker into anterior and posterior tubules. Develop in small, oval sporocysts in the digestive gland of the snail.

8. *Motion Picture of* Cercaria clausii *Monticelli, a Marine Rattenkönig Larval Trematode from the West Coast of Florida.* R. M. Cable, Purdue University, and Richard A. McLean, Academy of Natural Sciences of Philadelphia.

A short motion picture of *C. clausii* illustrates the behavior of this rare type of larval trematode. In some sequences, the clusters of larvae move as units, all members contracting simultaneously, while in others, the individual cercariae move independently as if attempting to detach themselves from the rosette.

9. Histoplasma capsulatum, *Its Biochemical and Immunological Properties.* GEORGE J. SCHEFF, Ohio State University.

The biochemical and immunological properties of the mycelial form of *H. capsulatum* have been studied. The biochemical behavior is characterized by slow utilization of sugars and by an early formation of ammonia from any available nitrogen source. This is enhanced rather than inhibited by the presence of glucose. Organic nitrogen compounds (asparagine) due to their catalytically active carbon structure, are definitely superior as nitrogen sources to inorganic nitrogen sources (ammonia sulphate). The decomposition of the nutrients is brought about by the interaction of various enzymes and an energy-yielding cycle of carbon metabolism. The latter includes succinate and fumarate which, when added definitely accelerate the growth and increase the yield of the mold. The fungus is able to elaborate some of its growth factors but has to be supplied with thiamine from outside.

The immunological behavior is similar to that of other fungi. Due to the slow development of the infection, no humoral antibodies are produced, but a high degree of specific skin sensitivity is established. In immunized animals the reverse conditions seem to prevail. From the mold, potent polysaccharide and protein fractions can be obtained. These give skin tests with infected animals and precipitation tests with the sera of immunized animals.

The results were compared with those obtained with other pathogenic fungi and a tentative explanation of these findings is proposed.

10. *The Incidence of Intestinal Protozoa in Mental Patients and in Cases Showing Symptoms of Amoebic Dysentery.* VIOLA M. YOUNG, Chicago Medical School and the Chicago Free Dispensary.

The stool specimens from 1649 mentally ill patients in Illinois State Hospitals, 500 of whom were newly admitted, 800 chronically institutionalized, and 349 with diarrhea were examined and the results compared with findings in 361 mentally sane patients showing symptoms of ameobic dysentery.

From the 349 cases of diarrhea among hospital patients, 30 were bacillary in origin, 15 amoebic, 203 food poisoning, and 101 had diarrhea of unknown origin. Of the 361 outside patients, 157 had amoebic dysentery, and 204 were non-microbial and non-protozoan in origin. Fresh stools and non-cathartic and post-cathartic in nature were examined unstained, iodine stained and finally after permanent staining.

Mental patients showed an increase in number of all protozoa during hospitalization due to the poor hygienic habits of these cases. The numbers of specimens harboring *E. nana, I. butchlii,* and flagellates increased sharply during diarrhea. The incidence of *Chilomastix mesnili, Giardia lamblia,* and *Trichomonas hominis* was so high in the group of "diarrheas of unknown origin" in mentally ill patients, that their connection with acute intestinal disturbance must be considered. *E. nana* and *E. coli* were more numerous in the mentally sane patients suffering from diarrhea than among the institutionalized. The occurrence of *Enteromonas hominis* and *Embadomonas intestinalis* during the winter 1943–44 was high both in cases of amoebic dysentery and non-specific diarrhea. No explanation could be found for this phenomenon.

11. *On the Staining of Protozoa in Human Blood and Feces.* OSCAR FELSENFELD, Chicago Medical School and the Chicago Free Dispensary.

The desire to save expensive chemicals and valuable time led to a search for simple, quick and cheap staining methods.

The rapid method of Johnson gives results that are inferior to those of the classic Heidenhain or Dobell stain for intestinal amoebas. When, however, Carnoy's fixative precedes Johnson's method instead of the alcoholic sublimate, more brilliant pictures are obtained. Mann's stain is not suitable for mass examination.

The methods of Giemsa, Wright, Romanowsky, Leishman and Field can be substituted by the simple and inexpensive procedures of Saye or of Chetnikoff for the staining of blood parasites and also of intestinal protozoa. The technique of Saye was originally devised for the staining of blood smears for differential counts. It is suitable for thin smears without alteration. When it is applied to thick smears, a preliminary dehemoglobinization has to be carried out. The usual formol-acetic acid mixture with subsequent neutralization proved satisfactory for this purpose. If Saye's method is used for smears from feces, fixation in Carnoy's or in Bouin's fluid has to precede the staining.

12. *The Occurrence of the Pentastomid,* Porocephalus crotali *Humbolt, in Rattlesnakes of Southwestern Oklahoma.* J. TEAGUE SELF, University of Oklahoma.

A collection of Pentastomids from the lungs and tracheae of *Crotalis a. atrox* Baird & Baird, collected on the Wichita Mountains Wildlife Refuge, has been furnished the author by Frank B.

McMurry. These have been determined as *Porocephalus crotali* (Humbolt 1808) Humbolt 1811, previously unreported in this region of the United States. Infections are common and heavy, as many as 158 specimens having been collected from a single host. The prevalence of *Porocephalis crotali* in this area suggests a wide distribution in the southwest.

13. *Paramphistomes of North American Domestic Ruminants.* Emmett W. Price and Allen McIntosh, U. S. Bureau of Animal Industry.

Until recent years it was generally believed that the rumen flukes of cattle in the United States belonged to the species *Paramphistomum cervi* (Zeder). Krull (1932, 1934) and Bennett (1936) reported on the life history of an amphistome which they regarded as *Cotylophoron cotylophorum* (Fischoeder) and since then this species has been regarded as the common rumen fluke of American livestock. During the past year the writers have studied the amphistome material available in the U. S. National Museum and find the following species to be present in American ruminants: *Paramphistomum cervi* (Zeder) in cattle, relatively rare; *P. liorchis* Fischoeder in cattle and deer in Florida and Louisiana, common in deer; *Cotylophoron* sp., possibly *C. cotylophorum,* in sheep in New York State, rare (one record); and *Paramphistomum microbothrioides,* n. sp., in cattle, common and widely distributed. *P. microbothrioides* is closely related to *P. microbothrium* Fischoeder, but differs from it in several respects, particularly in the number and distribution of the dorsal external acetabular muscle fibers. The dorsal external 2 fibers (Näsmark's nomenclature) consist of about 6 to 9 irregularly spaced units in *P. microbothrioides* in contrast to about 25 regularly spaced units in *P. microbothrium.* The species referred to as *Cotylophoron cotylophorum* by Krull (1932, J. Parasitol. **19:** 165–166; 1934, **20:** 173–180) and by Bennett (1936, Ill. Biol. Monogr. **14**(4) is identical with *P. microbothrioides.*

14. *Trypanosomes in North American Amphibians.* Ross F. Nigrelli, New York Zoological Society.

The following trypanosomes have been reported from North American amphibians: *T. diemyctyli* Tobey (1906) in *Triturus viridescens; T. clamatae* Stebbins (1907) in *Rana clamitans; T. parvum* Kudo (1922) in *Rana clamitans; T. cryptobranchi* Roudabush and Coatney (1937) in *Cryptobranchus alleganensis.* Recently, Fantham, Porter and Robertson (1942) reported as new *T. lavalia, T. gaumontis* and *T. montrealis* in *Bufo americanus* from Canada. Due to the extreme polymorphism demonstrated by amphibian trypanosomes, it is very difficult to determine the validity of these species. In addition, *Trypanosoma rotatorium* (Mayer, 1843) has been reported in *Rana clamitans, R. catesbiana, R. sphenocephala, R. pipiens, Bufo fowleri, Hyla crucifer,* and *Pseudacris brimleyi. Trypanosoma inopinatum* Ed. and Ét. Sergent (1904) was reported in *R. pipiens.* In the present survey the following amphibians were found infected: *Triturus viridescens, Acris gryllus, Hyla versicolor, H. crucifer, H. andersoni, R. pipiens, R. clamitans* and *R. catesbiana.* The trypanosome found in *Acris* is considered new and the name *Trypanosoma grylli* is proposed. Twenty-four individuals examined were found to be 100 per cent infected. The parasites, which are present in large numbers, approach the size reported for human trypanosomes and resemble them in many respects. They measure from 15.7 to 20 microns in length (av. 17.43) and from 4.2 to 6.6 microns in width (av. 5.4). The body is highly metabolic and the cytoplasm shows considerable vacuolation. However, the form taken by these trypanosomes is a constant feature. The posterior end is rounded, while the anterior end tapers slightly. The kinetoplast is well developed, the parabasal body lying a short distance from the posterior end. The undulating membrane is not exceptionally formed, but the free flagellum is comparatively long. The nucleus is always posterior in position, invariably lying close to the kinetoplast.

15. *A Blood Parasite of the Turkey.* E. McNeil and W. R. Hinshaw, University of California.

This paper reports the finding of an intra-erythrocytic blood parasite from 10-week-old turkey poults. It varies in diameter from 0.5 μ to 2.0 μ with an average of 1.0 μ, and is situated approximately halfway between the nucleus and the edge of the cell. It is usually almost round, but may be oval or pear-shaped. Usually there is only one parasite within a cell, and never more than two. It has been found in cells in the liver and in the peripheral blood. The blood picture shows a slight anemia with some poikilocytosis. At autopsy the principal findings are flabby hearts, congestion of the intestine with diarrhea, and failure of the blood to clot normally. This parasite probably belongs in the Babesiidae, and rather closely resembles *Sauroplasma thomasii* Du Toit.

16. *The Continuous Culture of Pure Clones of* Dero limosa *Infected with* Adelina deronis. Theodore S. Hauschka, Lankenau Hospital Research Institute.

Uninfected clones of the aquatic oligochaete *Dero limosa,* derived by fission from single individuals, may be grown continuously on scalded lettuce with the addition of eight B-complex

vitamins (Hauschka, 1944, Growth **8:** March issue, in press). Worms heavily infected with the coccidian *Adelina deronis* (Hauschka, 1943, J. Morph. **73:** 529–582) can likewise be cultured on the above medium. The marked transparency of the host facilitates determination of the extent of infection in vivo. Close correlation was found between severity of infection and fission frequency which is relatively constant in parasite-free controls. For instance: Eight uninfected clones, each derived from a single animal, showed the following increase after four weeks: 5, 6, 7, 7, 7, 8, 8 (average 6.75; range 5–8). Eight infected lines, also derived from single worms, after four weeks contained: 1, 2, 2, 4, 5, 6, 7, 8 animals (average 4.37; range 1–8). With proper care, i.e., change of culture medium and dish twice a week, even the most heavily parasitized clones will survive for indefinite periods. At present (June 1944), five infected pure-line clones have been growing for nine months and show no decline. Th cultures contain infections of varying intensities with no indication of acquired immunity. The nine-month-period of culture represents 27 generations of the host and approximately 15 generations (life cycle 18 days) of the parasite.

17. *A Case of* Trichostrongylus sp. *with Notes on the Identification of Ova.* H. Tsuchiya and Helen Reller, Washington University.

A patient, 56 years of age, Greek, entered Barnes Hospital with complaint of intermittent pain in epigastrium and upper right quadrant, chronic constipation, dyspnoea, productive cough, headache, ringing of left ear and a loss of 28 pounds in one year. Stool examination revealed a few ova of *Trichostrongylus sp.* (by Willis flotation method) and cysts of *Giardia lamblia.* Blood counts: red cells, 5,120,000; white cells, 6,400; haemoglobin, 86 per cent; no eosinophiles. He died shortly after admission. Clinical diagnosis: generalized abdominal carcinomatosis, senile emphysema and syphilis of undiagnosed site. Since autopsy was not performed, the species of *Trichostrongylus* remains undetermined. As compared with hookworm ova, they are much longer and slightly wider, measuring 81 to 97 microns in length by 40 to 51 microns in width, averaging 86 by 43 microns, and have elongated oval-shape with transparent shell membrane which is thicker and more greenish and lustrous. While the ends of the ova are more pointed than those of hookworm, in a majority of them one end is somewhat pointed while the other is rounded, resembling somewhat the shape of a grape. The pointed end appears slightly thicker than the non-pointed end. Ova in freshly voided stool present 16–24 morula stage of embryonation which, together with the characteristics described above, differentiate them from hookworm ova.

18. *The Production of Anemia in Lambs by Hookworms,* Bunostomum trigonocephalum. John T. Lucker and Eleanor M. Neumayer, U. S. Bureau of Animal Industry.

A *Bunostomum*-free lamb receiving percutaneously a dose of 50,000 hookworm larvae, when 4½ months old, became heavily infected and markedly anemic. Another lamb, that had failed to become appreciably infected following oral administration of 5,000 larvae, also became markedly anemic following application to its skin, when 8½ months old, of 11 doses totalling 112,000 larvae. The lowest observed levels in cell-volume percentages, hemoglobin and erythrocytes occurred 11 to 14 weeks after infection and were about one-half normal values. At necropsy, 17 to 19 weeks after infection, these lambs harbored, respectively, 1,500 and 2,000 hookworms. A third lamb, which had failed to become infected following oral administration of larvae, received percutaneously, when 8½ months old, 580,000 larvae in two applications. A light infection characterized by moderate anemia resulted. Blood appeared in the feces of these lambs within 25 days after infection. A fourth lamb developing a light infection but no anemia following application to its skin of 5,000 larvae in 10 equal weekly doses, remained unaffected when 560,000 larvae were applied to its skin in 11 doses 4 months later. At necropsy these lambs harbored respectively 80 and 190 hookworms. These four lambs were fed alfalfa hay and grain. In an uncompleted experiment involving two identically dosed groups of younger lambs, one receiving this diet and the second timothy hay, a lamb on the latter diet developed an extreme anemia terminating fatally about 7 weeks after infection, before eggs appeared in its feces.

19. *Comparative Growth Rates of Amoebae and Bacteria in Cultures of* Endamoeba histolytica *and Organism* t. Chas. W. Rees and Lucy V. Reardon, National Institute of Health.

Endamoeba histolytica and a single species of bacteria, organism *t*, were grown in Florence flasks of 250 ml capacity in diphasic media of coagulated whole egg, coagulated egg white, and liver infusion agar, respectively; also in a number of wholly liquid media. The basic liquid was Locke's solution without serum supplemented with rice flour, buffered with egg shell, and with and without other enrichment. Excepting whole egg medium, enrichment with 8 water-soluble vitamins and cholesterol was used. The liquid media contained commercial peptones or papain digests of peanut, soy-bean, cottonseed, rice, coagulated whole egg or egg white, and dried hog liver. Amoeba growth was determined by haemocytometer counts and bacteria growth by gas

measurements. At 72 hours of cultivation each flask of diphasic whole egg and enriched egg white medium produced up to 3,000,000 amoebae and 100 ml of gas. Liver infusion agar produced few amoebae and much gas. Without vitamin-cholesterol enrichment, egg white medium gave poor growth of amoebae and bacteria. Without dextrose all media gave poor growth of both organisms. In several cases digest media produced about 1,000,000 amoebae but poor growth in other cases. With several exceptions bacteria growth in digest media was as high at 24 hours as in good amoebae producing media at 72 hours. Twelve commercial peptones with vitamins and cholesterol gave poor growth of amoebae and excellent growth of bacteria.

In culture with organism *t, E. histolytica* utilizes cholesterol, rice flour, undermined ingredients of egg white, and vitamins. Organism *t* utilizes dextrose, vitamins, and nitrogenous materials occurring in all the media that were tested.

20. *Inoculations of* Trichomonas foetus (*Protozoa*) *in Heifers.* Banner Bill Morgan, University of Wisconsin.

Nine virgin heifers, all about 12 months of age, were injected with *Trichomonas foetus.* Five of the heifers were inoculated intramuscularly along the mid-neck with 5 ml of living, washed, bacteria-free trichomonads approximately twice per week for a period of 3 months. The suspension began with 5 million organisms per ml and ended with 50 million. Two heifers were injected intramuscularly with formalin-killed trichomonads. The remaining 2 heifers were injected intravenously with living trichomonads. Each animal received 17 injections. In the sera of these heifers immobilization of the trichomonads was observed in dilutions ranging from 1:4 to 1:128. One animal which had been injected intravenously died of an intussusception as a result of an anaphylactic shock. At the first heat period after the last injection each cow was artificially inseminated with fresh normal semen. Twenty-four hours later all cows were inoculated in each uterine horn with 10 ml of motile *T. foetus* containing 50 million organisms per ml. Nine noninjected, virgin heifers, all about 12 months of age, used for controls were inseminated and inoculated in a similar fashion. Four of the heifers conceived on the first service and calved normally. Two conceived on the second insemination, 2 on the third, and all gave birth to normal calves. The remaining heifer developed a mild case of rickets and was given a short breeding rest, but this animal conceived and calved normally after the fourth insemination. All nine controls developed varying degrees of vaginitis, endometritis and pyometra. One heifer produced a normal calf but only after a severe case of pyometra. Trichomonads were isolated at various intervals from the controls; however, in only one injected heifer could the organisms be found.

21. *The action of Negro and White Sera on Infective Hookworm* (Necator americanus) *Larvae.* Gilbert F. Otto, Evelyn Allen and Sterling Brackett, Johns Hopkins University.

The precipitin reaction resulting from living hookworm larvae in human sera had no demonstrable relation to the infection status of the individuals from which the sera were obtained. Less than 30 per cent of the whites from the endemic area had sera which reacted strongly whereas 90 per cent of the negroes had reacting sera of which about two-thirds reacted strongly. Studies in progress suggest that negroes outside the endemic area may have strongly reacting sera.

22. *Tests to Determine the Ability of Species of Domestic Mosquitoes to Transmit* Wuchereria bancrofti. Walter L. Newton and Willard H. Wright, National Institute of Health.

Because of the possibility of the reestablishment of filariasis in the continental United States through the return of infected individuals from endemic areas abroad, tests are being carried out to determine the domestic mosquito vectors of *Wuchereria bancrofti* (periodic form). To date, a total of 951 dissections has been made of 7 species of mosquitoes, 640 of which lived 9½ days or longer after feeding on an infected individual. In a control test with a relatively small number of *Culex quinquefasciatus,* all specimens developed infective larvae, thus confirming the findings of Francis (1919) that this species is an efficient vector in the continental United States. Of the 6 other species, the respective percentages which developed infective or potentially infective microfilariae were, as follows: *Anopheles albimanus* 67; *Psorphora confinnis* 12; *Culex nigripalpus* 6.8; *Aedes aegypti* 4.9; *Aedes sollicitans* 0; and *Aedes taeniorhynchus* 0. These results indicate that *A. albimanus, P. confinnis, C. nigripalpus,* and *A. aegypti* are potential vectors. Apparently, the salt marsh species, *A. sollicitans* and *A. taeniorhynchus* would be incapable of transmitting infection under the conditions prevailing during these experiments.

23. *Agglutination of Microfilariae from* Litomosoides carinii *of the Cotton Rat by Normal Serums.* James T. Culbertson and Harry M. Rose, Columbia University.

When normal serum from man or from certain laboratory animals (e.g., rabbit) was added to a suspension of embryos obtained from *Litomosoides carinii* of the cotton rat, the embryos were

agglutinated. The tests were carried out on microscope slides. One drop of undiluted, inactivated serum was added to one drop of a heavy suspension of embryos on the slide, and the slide rotated to effect mixing of the fluids. The mixtures were examined for agglutination after 10 minutes under seven times magnification. Among 55 unselected Wassermann laboratory blood serum samples, 39 (70.9%) were positive. The serums of albino rats and of cotton rats (some of the latter animals infected with *Litomosoides carinii* and others not infected) did not agglutinate the embryos.

24. *Cross Reactions between Polysaccharides from Various Animal Parasites.* José Oliver-González, School of Tropical Medicine, Puerto Rico.

A polysaccharide fraction has been isolated from the following helminths: *Ascaris lumbricoides, Trichinella spiralis, Necator americanus, Schistosoma mansoni, Fasciola hepatica* and *Taenia saginata,* using the method described by Melcher and Campbell (1942). The purified polysaccharide fractions seem to have a very close immunological relationship to each other. Each of the fractions, when added in suitable concentrations to human serums, inhibit the α and β isoagglutinins present in the serums. The serums of rabbits immunized with any of the polysaccharide fractions react to about the same precipitin titer with the homologous and heterologous polysaccharide test antigens. The following table is illustrative:

Test antigen	Antiserum
Polysaccharide from:	Rabbit immunized with polysaccharide from *Taenia saginata*
	Precipitin titers
A. lumbricoides	12,800
T. spiralis	12,800
N. americanus	12,800
F. hepatica	6,400
S. mansoni	6,400
T. saginata	12,800

The presence of such a common antigenic substance in all of the above-mentioned helminths may be of importance in relation to cross reactions which might exist between these organisms during infection or during artificial immunization. Investigations on this particular point as well as on the relations between the polysaccharide fractions and the human isoagglutinogens are in progress.

25. *The Effects of Host Starvation on Worm Elimination and Glycogen Depletion with the Nematode* Ascaridia galli. W. Malcolm Reid, Monmouth College.

The mature fowl nematode *A. galli,* like the cestode *Raillietina cesticillus* (J. Parasitol. **28**: 319–340), is eliminated from the host by short starvation periods. Although cestode strobilae were passed in 24 to 48 hours, the nematode required 48 to 96 hours of starvation. Ten out of 14 fowls lost all parasites at the end of of 96 hours, while the remaining four contained but 1, 2, 5, and 11 worms. Ten unstarved controls contained from five to 45 worms at autopsy, the average infection being 22.7 worms. Thirteen of the experimental group eliminated one to 19 worms with an average of 7.2 parasites per fowl, while four controls lost single worms during the experiments. It is probable that many dead parasites were not recovered from starved hosts since the worms in the droppings showed various stages of degeneration.

The glycogen content of female worms removed from unstarved chickens averaged 4.63 per cent, while after 24 hours of host starvation this level was reduced to 1.35 per cent and after 48 hours to 0.49 per cent. Males under similar conditions showed an average of 3.60, 1.36 and 0.46 per cent respectively. Extreme glycogen depletion is correlated with and possibly responsible for the elimination of these two species of parasites. This sensitivity of parasites to feeding conditions of the host needs to be considered in planning for, carrying out, and interpreting experiments.

26. *Substitution of Soybean Oil Meal for Animal Protein in Developing Resistance of Animals to Parasitism.* J. E. Ackert, Dorothy S. Branson, D. J. Ameel and B. B. Riedel, Kansas State College.

In previous experiments it was found that when peanut meal was used as a protein supplement to a basal cereal ration the resistance of chickens to the viability and growth of the fowl

ascarid *Ascaridia galli* was lowered in comparison with that of fowls whose basal cereal ration was supplemented with meat scraps or meat scraps and milk.

Similar tests on more than 400 growing chickens parasitized with *A. galli* have been made with a soybean oil meal supplement in place of the peanut meal. Other groups of chicks of the same age were given meat scraps, or meat scraps and powdered skim milk as supplements to the otherwise adequate cereal basal ration.

The soybean oil meal group, instead of having more worms and longer ones as in the case of the peanut meal groups, had *A. galli* in approximately the same average number and length as those in the meat scraps, or in the meat scraps and milk supplement group. The trend was toward higher resistance in the soybean oil meal group, but the differences were not significant. The explanation for the success of this all-plant ration in producing host resistance probably lies in the high percentage of protein digestibility of soybean oil meal in growing fowls.

27. *Studies on Effects of Helminths on Growing Chickens.* J. E. Ackert and C. L. Wisseman, Jr., Kansas State College.

Tests were made of effects on chickens of smaller numbers of the nematode *Ascaridia galli* and of the cestode *Raillietina cesticillus,* respectively. Of 30 chicks maintained on an adequate diet, 15 were parasitized with 100 embryonated eggs of *A. galli* and the balance kept as controls. Comparisons of weights, haemoglobin percentages, and blood sugar levels showed no significant differences between the parasitized and control groups. Post-mortem examinations showed infections of from one to 46 *A. galli,* with an average of 17.9 worms per chicken. Lack of conclusive evidence of harmful effects of the worms is attributed to an improved ration for the chickens and to the variability of the blood sugar levels of the chickens.

Tests for effects of moderate infections of tapeworms on chickens were carried out on 44 young chickens, half of which were parasitized with the fowl tapeworm *Raillietina cesticillus,* and the balance kept as controls. All chickens were kept on the same adequate ration. Weekly weight records were taken and blood sugar levels and haemoglobin percentages were taken after two weeks and eight weeks of parasitism. Differential white cell counts were made four weeks after infection. Although 21 of the birds had 16 or more tapeworms and five had in excess of 100, no constant differences in the parasitized and controlled groups were found in growth of chickens, blood sugar level, haemoglobin estimate or differential white cell counts. These results indicate that if all of the ingredients required by growing chickens are supplied, the young fowls can tolerate considerable numbers of tapeworms without serious effects.

28. *The Effects of Nematode Infections During the Prepatent Period on the Calf.* Roy L. Mayhew, Louisiana State University.

Weights of six calves kept under parasite-free conditions were found to have their rate of gain very much reduced when inoculated with pure suspensions of stomach worm (*Haemonchus contortus*) larvae and mixed suspensions of stomach worm and nodular worm larvae (*Oesophagostomum radiatum*). As the larvae reached maturity, and eggs appeared in the manure, the regular rate of gain was resumed and maintained.

The deaths of six animals inoculated with mixed suspensions of stomach and nodular worms have resulted during the larval period of these parasites. These animals were raised parasite-free and the results of inoculation were confirmed at post mortem by marked inflammation in the stomach and small and large intestines and by the recovery of the parasites.

The severe anemia which has been found to develop during the prepatent period may lower the general resistance of the calf to the other diseases.

29. *Alcoholism in Mice and Its Effect on Natural and Acquired Resistance to* Hymenolepis nana *var.* fraterna. John E. Larsh, Jr., University of North Carolina.

Young mice have been tested to determine the effect of alcoholic intoxication on natural and acquired resistance to *H. nana* var. *fraterna.* The first tests were made after three weeks daily treatment with 0.4 cc of 35 per cent alcohol by mouth. Following proportionate egg doses, cysticercoid counts showed about twice the number of parasites in the alcoholic group as in controls of the same age. Animals reacted differently which were immunized by infection several days before beginning the alcohol. Very few cysticercoids were observed in either the alcoholic or the non-alcoholic group, whereas there were typical numbers in a second non-alcoholic group which was not infected previously. Tests were made to see what the effect would be of intoxication produced just one hour prior to initial infection. The controls had typical numbers of parasites, but exceedingly few were observed in mice of the intoxicated group. During intoxication the rectal temperature falls sharply from 37° C to 33° C and remains low for several hours. Inasmuch as this may have had an effect on the hatching of the eggs, tests were designed to control it. After intoxication the mice were placed in a large incubator at 37.5° C and within an hour when the temperature returned to normal they were infected. About the same number of

parasites was observed in both the alcoholic and non-alcoholic group. Thus alcohol appears to interfere with the mechanism of natural resistance but not the immune state. How the drug exerts its deleterious effect is unknown but studies on this are in progress.

30. *Critical Tests with a Hexachlorethane-bentonite-water Suspension as a Fasciolicide in Cattle.* O. Wilford Olsen, U. S. Bureau of Animal Industry.

Post-mortem examinations on 34 grown range cattle in the Gulf Coast region of Texas, known to have been infected with *Fasciola hepatica* at the time of treatment, showed that a single dose of hexachlorethane suspended in bentonite and water (Olsen, 1943, J. Am. Vet. Med. Assoc. **102:** 433–436) was highly efficacious against liver flukes, especially against the adult worm.

A total of 74 young flukes and 17 adult flukes were found in the livers of the 34 treated animals, 10 to 50 days after treatment. The mean number of young flukes per treated animal was 2.16, the range being 1 to 13 each, in 17 cows; the mean number of adult flukes was 0.5 per animal, the range being 1 to 5 each, in 7 cows. The mean number of flukes of all sizes for the 34 animals was 2.67, with a range of 1 to 13 each, in 21 cows.

Seven control cows, slaughtered from the same herd on the same date with 13 of the experimental cows, showed a total of 181 young flukes and 100 adult flukes. The average number of young flukes was 25.8, with a range of 55 to 126, in 2 animals; the average number of adult flukes was 14.2, with a range of 6 to 44 each, in 5 cows. The average number of flukes of all sizes for each of the control cows was 40.1.

All except extremely debilitated cattle tolerate a dose of 100 grams of hexachlorethane in suspension (200 ml) very well. Cattle in average condition have received twice this dose without showing untoward effects.

31. *Common Names of Helminths.* Donald B. McMullen, University of Oklahoma; H. L. Van Volkenberg, Texas Agricultural and Mechanical College; and Paul D. Harwood, Drs. Hess and Clark Laboratories, Inc.

Helminthologists, who are in contact with governmental extension services, or with commercial organizations, are frequently perplexed by a demand for common names of parasitic worms because there is no established or uniform usage in many instances. Accordingly, a committee of this society was charged with preparing a tentative list. Textbooks by American authors, bulletins from the U. S. Department of Agriculture and from the various states were searched for common names already in use. Established names should be accepted with as little change as may be necessary to prevent duplication. However, a variety of worms have been called simply stomach worms by various authors. In the publications where these names appear, the meaning is clear, but for purposes of a list of common names, other delimiting adjectives or phrases may be necessary. Thus *Hyostrongylus rubidus* may be called the red stomach worm of swine. Also similar names should be used for related worms. In a very few instances new or highly modified names may be necessary. However, the committee believes that a list of common names to be useful must be a cooperative project. Therefore, the names proposed by the committee are regarded merely as a basis for discussion. Opinions have been, or will be, sought from many parasitologists, and on this basis a preferred name will be proposed. Therefore, a common name is sought which is brief, descriptive, and preferred by the majority of scientists.

32. *A Reaction of Rat Serum to Embryonated Eggs of* Trichosomoides crassicauda. Vivian S. Smith, University of Illinois.

Serum from albino rats infected with *Trichosomoides crassicauda* was used in the preparation of vaseline-sealed coverglass cultures of *T. crassicauda* eggs. Cultures were prepared using eggs repeatedly washed in sterile saline after being teased from gravid female worms.

After incubation at 37° C for eight hours or longer, a flocculum was observed around numerous embryonated eggs. Serum of rats which had been repeatedly infected showed earlier appearance of flocculum, more numerous eggs affected, and greater amounts around individual eggs, as compared with rats which had been infected only once. Control cultures using serum of animals which had been kept parasite-free showed no reaction to *T. crassicauda* eggs. Although several larvae generally hatched out in each culture, and were observed to survive as long as 11 days, no flocculum appeared around them in any instance.

A satisfactory explanation for the serum reaction to embryonated eggs rather than to larvae has not been worked out at present. However, the reaction is thought to be of antigen-antibody nature.

33. *Studies on the Relationship of* Trichosomoides crassicauda *Infection in Rats to Mucoid Calculi of the Urinary Bladder.* Vivian S. Smith, University of Illinois.

An unusual type of calculus is commonly found in the urinary bladders of wild and laboratory rats. Of 32 instances among 370 wild rats, 27 calculi were associated with the presence of

Trichosomoides crassicauda. Among albino laboratory rats used for *T. crassicauda* experiments, however, two of nine vesical calculi were in control animals which had been raised parasite-free. Although mice have not been reported to harbor this helminth parasite, two typical calculi were found in albino males. A striking feature is that all of the above-mentioned instances were in male animals except for two cases in female wild rats.

Vesical calculi of the type described are irregular in shape, whitish in color, and of a soft gum-rubber consistency. Sections frequently showed worms embedded in the acellular matrix. Dried ground calculus material gave a strongly positive biuret test. Use of mucicarmine stain on sections indicated that the masses were composed largely of mucin.

T. crassicauda is not believed to initiate calculus formation, but may possibly serve as a secondary factor. Preponderance of mucoid calculi in male animals is not definitely explained. A hypothesis that seems feasible is that a back-flow of mucoid secretion from the seminal vesicles and prostate into the urinary bladder might occur under certain conditions. Presence of worms would further favor calculus formation by inducing excess secretion of mucus through irritation of the bladder epithelium. Experimental operative insertion of various foreign substances into the bladder failed to induce formation of mucoid calculi.

34. *The Possibility of Eliminating the Schistosome Snail,* Australorbis glabratus, *from Canals by Control of Water Flow.* GEORGE W. LUTTERMOSER, Oficina Cooperativa Inter-Americana de Salud Publica (Venezuela).

In order to determine which water velocities the snail carrier of *Schistosoma mansoni, Australorbis glabratus,* could resist, the following canals were used: a wooden canal 5 meters long by 15 cm deep by 21 cm wide and a semi-circular concrete canal with a radius of 7.6 cm and a length of 5 meters. Several adult snails were placed in the lower end of the canals and a stream of water entered the higher end. The flow of water and the slope of the canals were fixed and determined for each test.

In the 14 experiments with the wooden canal, it was found that the snails were able to maintain themselves for more than three hours and advance upstream 26 and 52 cm per hour in the water at velocities of 0.06 and 0.15 meter per second. When the water velocity was increased to 0.25 meter per second, the snails were only able to remain in the canal for three hours and they advanced upstream 1 to 3½ cm per hour. In velocities of 0.32 or 0.33 meter of water per second, the *A. glabratus* made no progress upstream and were all washed downstream within an hour. Flows of 0.38 to 0.42 meter per second prevented the snails from going upstream and they were all carried away in 10 to 30 minutes. The results of 10 experiments with the concrete canal were similar to those with the wooden canal.

It is concluded that relatively low water velocities should eliminate *A. glabratus* from well-constructed canals in the field. A test of this possibility is being made.

35. *The Parasites of the Plethodontidae (Amphibia–Caudata) III.* A. C. WALTON, Knox College.

Annotated lists of the parasites of the Plethodontidae indicate the following hosts and parasites: (a) *Eurycea tynerensis* (U.S.A.)—*Acanthocephalus vancleavi* (Acanthocephala). (b) *Hydromantes genei genei* (S. Europe)—*Chondrostagon haematicum,* and *Pirhaemocyton tarentolae* (Protozoa); and *Batrachobdella algira* (Hirudinea). (c) *Pseudotriton montanus* (U.S.A.)—*Physaloptera* larvae of Morgan, 1941 (Nematoda); *Allocreadium pseudotritoni, Gorgodera amplicava,* and *Gorgoderina bilobata* (Trematoda); *Haptophrya michiganensis, Proteromonas longifila,* and *Trichomonas augusta* (Protozoa); and *Hannemania dunni* (Acarina). (d) *Pseudotriton ruber* (US.A.)—*"Oxyuris" dubia,* and (?) *Oxysomatium brevicaudatum* (Nematoda); *Allocreadium pseudotritoni, Brachycoelium salamandrae, Gorgodera amplicava, G. cygnoides, Gorgoderina bilobata,* and "Metacercariae" of Rankin, 1937 (Trematoda); larval *Crepidobothrium* sp? of Rankin, 1937, *Ophiotaenia cryptobranchi,* and Proteocephalid cysts of Mann, 1932, and of Rankin, 1937 (Cestoda); and *Cryptobia borrelli, Cytamoeba bacterifera, Eutrichomastix batrachorum, Hexamastix batrachorum, Hexamita intestinalis, Karotomorpha swezyi, Proteromonas longifila,* and *Trichomonas augasta* (Protozoa).

36. *The Parasites of the Plethodontidae (Amphibia—Caudata) IV.* A. C. WALTON, Knox College.

Annonated lists of the parasites of the Plethodontidae indicate the following hosts and parasites: (a) *Plethodon cinereus (P. erythronotus)* (Canada)—*Angiostoma plethedontis,* and *"Oxyuris" magnavulvaris* (Nematoda); *Brachycoelium salamandrae,* and *B. sp?* of Rankin, 1938 (Trematoda); larval *Crepidobothrium* sp? of Rankin, 1937 (Cestoda); and *Cryptobia borrelli, Cytamoeba bacterifera, Eutrichomastix batrachorum, Haptophrya michiganensis, Hexamastix batrachorum, Hexamita batrachorum, H. intestinalis, Karotomorpha swezyi, Proteromonas*

longifila, and *Trichomonas augusta* (Protozoa). (b) *Plethodon glutinosus* (U.S.A.)—*"Oxyuris" magnavulvaris,* larval *Physaloptera sp?* of Walton, 1935, and of Rieber, Byrd, and Parker, 1940 (Nematoda); *Brachycoelium salamandrae;* and *B. sp?* of Rankin, 1938 (Trematoda); Proteocephalid cysts of Mann, 1932, and of Rankin, 1937 (Cestoda); *Acanthocephalus acutulus* (Acanthocephala); *Cryptobia borrelli, Cytamoeba bacterifera, Eutrichomastix batrachorum, Haptophrya gigantea, H. michiganesis, Hexamastix batrachorum, Hexamita batrachorum, H. intestinalis, Karotomorpha swezyi, Proteromonas longifila,* and *Trichomonas augusta* (Protozoa); and *Hannemania dunni* (Acarina). (c) *Plethodon metcalfi* (U.S.A.)—*Brachycoelium salamandrae* (Trematoda); larval *Crepidobothrium sp?* of Rankin, 1937, and *Ophioteania cryptobranchi* (Cestoda); and *Cryptobia borrelli, Eutrichomastix batrachorum, Hexamastix batrachorum, Hexamita intestinalis, Karotomorpha swezyi, Proteromonas longifila,* and *Trichomonas augusta* (Protozoa). (d) *Plethodon yonahlossee* (U.S.A.)—*"Oxyuris" magnavulvaris* (Nematoda); *Brachycoelium salamandrae* (Trematoda); and *Cytamoeba bacterifera, Eutrichomastix batrachorum, Karotomorpha swezyi, Proteromonas longifila, and Trichomonas augusta* (Protozoa).

37. *The Parasites of the Proteidae and the Sirenidae (Amphibia – Caudata).* A. C. Walton, Knox College.

Annotated lists of the parasites of the Proteidae indicate the following hosts and parasites: (a) *Necturus maculosus* (U.S.A.)—larval *Eustrongylides ignotus,* and *Oswaldocruzia subauricularis* (Nematoda); ? *Crepidostomum cooperi,* ? *C. cornutum,* ? *C. farionis* (also in Canada), *Gorgoderina schistorchis, Monocaecum baryurum* (Canada), *Neochasmus umbellus, Sphyranura oligorchis, S. osleri,* and *Telorchis necturi* (Trematoda); ? *Nematotaenia dispar,* and *Ophiotaenia lönnbergii* (Cestoda); *Trichodina pediculus* (Protozoa); and *Simpsonichoncha ambigua* glochidia (Pelecypoda). (b) *Proteus anguinus* (Europe)—*Agamonema proteis-anguini,* and *Hedruris androphora* (Nematoda); and *Chloromyxum protei* (Protozoa). Study of the Sirenidae indicate the following host and parasites: (a) *Siren lacertina* (U.S.A.)—*Multicaecum tenuicolle, Oxysomatium americana,* and *Spironoura catesbianae* (Nematoda); and larval *Cephalogonimus amphiumae,* larval *Clinostomum marginatum, Diplostomulum sirenis, D. trituri, D. sp?* of Manter, 1938, larval, *Distoma sirenis lacertinae, Gorgodera minima,* larval *Monostomulum asperum,* and *Telorchis sirenis* (Trematoda).

38. *Effect of Skim Milk on Infections of Ascarids, Whipworms, and Nodular Worms in Swine.* L. A. Spindler and Harry E. Zimmerman, Jr., U. S. Bureau of Animal Industry.

Spindler, Zimmerman and Hill (1944, Proc. Helm. Soc. Wash. 11(1): 9–12) reported that pigs fed only fluid skim milk for 3 to 5 days expelled during that time the vast majority of their whipworms and nodular worms and smaller numbers of ascarids. Subsequently a test was carried out to ascertain whether by feeding skim milk, infections of the parasites named could be kept at a low level in pigs constantly exposed to infection. Nine 12-weeks-old, littermate pigs, free of worms, except *Strongyloides,* were divided into 3 equal groups and kept on contaminated ground. Pigs of group 1 were fed as much skim milk as they would drink each evening; group 2 was fed skim milk as the sole component of the diet for 3 days at intervals of two weeks; in both cases the quantity administered was sufficient to produce copious purging. When milk was not being fed, a balanced grain ration was fed on the ground. Group 3 was fed only grain on the ground and therefore served as a control.

At post mortem after 98 days on test, worm infections found in the control pigs (group 3) were as follows: Ascarids, 55, 116, 88; whipworms, 150, 97, 221; nodular worms, 115, 225, 153. None of the group 2 pigs harbored any of the parasites named. Two of the group 1 pigs were uninfected, and the third harbored 20 whipworms.

Results of this investigation indicate that frequent administration to pigs of fluid skim milk in quantities sufficient to purge will protect the animals against severe infections of the helminths named.

39. *An in vitro Method for the Bio-Assay of Chemotherapeutic Agents in Filariasis.* Harry M. Rose, James T. Culbertson and Eleanora Molloy, Columbia University.

A satisfactory *in vitro* method has been devised for the biological assay of chemotherapeutic agents in filariasis, using *Litomosoides carinii* as the test organism. This parasite is found naturally to infect a considerable proportion of Florida cotton rats, the adult worms invariably residing in the pleural space, while unensheathed, non-periodic microfilariae occur in the peripheral blood of the animals.

The adult parasites are removed from the thoracic cavity with aseptic precautions, and suspensions of microfilariae are obtained by washing out the pleural space with sterile physiological saline. Adults and microfilariae are then transferred to 50 ml. Erlenmeyer flasks containing 10 ml. of sterile physiological serum-salt solution (Simms) prepared as follows:

Solution A	*Grams per liter*
NaCl	160.0
KCl	4.0
$CaCl_2$–$2H_2O$	0.88
$MgCl_2$–$6H_2O$	4.06
Solution B	
NaH_2PO_4–H_2O	2.2
Na_2HPO_4	18.4
$NaHCO_3$	1.3
Dextrose	20.0
Phenol red	0.2

Dilute one volume of Solution A with 18 volumes of distilled water and autoclave. Sterilize Solution B by filtration through a sintered glass filter. For the final solution (pH 7.4) add one volume of B to 19 volumes of diluted A, plus sufficient normal horse serum to make a concentration of 10 per cent.

In this menstrum adult filariae and microfilariae remain viable for at least one week at 37° C. At room temperature the parasites will live from one to three weeks. Drugs to be tested may be added in any desired concentration, and the authors have already demonstrated by this method that the *in vitro* action of neostam and neostibosan closely parallels their effects *in vivo*.

The present method is the first to be described in which drugs may be tested *in vitro* against both adult filariae and microfilariae.

40. *The Trombiculid Mites (Chigger Mites) and Their Relation to Disease.* Henry E. Ewing, U. S. National Museum.

Presidential Address.

SYMPOSIUM ON PARASITOLOGY IN RELATION TO THE WAR

1. *The Wartime Importance of Tropical Diseases.* James S. Simmons, Brig. General, Medical Corps, United States Army.

No abstract.

2. *Malaria and the War.* O. R. McCoy, Major, Medical Corps, United States Army.

No abstract.

3. *The Development of Malarial Sporozoites in the Vertebrate Host.* Clay G. Huff and Frederick Coulston, University of Chicago.

No abstract.

4. *The Present Status of the Filariasis Problem.* Harold W. Brown, Columbia University.

Filarial infections acquired by our armed forces in the Pacific theater of war have stimulated a renewed interest in the problem of filariasis. Although it appears that the only endemic focus of filariasis in Charleston, South Carolina, has disappeared, the possibility of new endemic foci in this country is discussed. Clinical studies have been reported by medical officers in the armed forces which indicate that filarial infections acquired by white adults may differ in their course from infections acquired by natives in childhood. The prolonged prepatent period of infections in adult Americans necessitates a re-evaluation of clinical and laboratory diagnostic methods. Recent studies on the treatment of filariasis indicate that certain antimony compounds possess considerable filaricidal powers. Continuation of these therapeutic studies have led to the discovery of a number of organic compounds of considerable therapeutic promise.

5. *Distribution and Control of the Fevers of the Typhus Group.* R. E. Dyer, Assistant Surgeon General; Director, National Institute of Health.

This group of fevers is widespread throughout the world.

Epidemic typhus—Europe, Asia, Africa, South and Central America.

Endemic typhus widely distributed in the tropics and subtropics, but also in temperate climates including the United States.

Scrub typhus—Japan, Southeastern Asia, and the islands of the Southwest Pacific.

Rocky Mountain spotted fever—the Western hemisphere with somewhat similar tick-borne infections around the Mediterranean, East and South Africa, and India.

Control of these diseases depends upon control of the reservoir and of the arthropod vector.

	Reservoirs	Vectors
Epidemic typhus	Man	Body louse
Endemic typhus	Rat	Rat flea
Scrub typhus	Field mice	Mites
Rocky Mountain spotted fever and allied tick-borne diseases	Rodents and domestic animals	Ticks

Measures for control:

Epidemic typhus—Proper isolation of cases with delousing of contacts. Vaccination.

Endemic typhus—Control of the common rat.

Scrub typhus—Personal care, insect repellents.

Rocky Mountain spotted fever—Personal care, repellents, vaccination.

6. *Development of Louse Powders for the Armed Forces.* WALTER E. DOVE, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture.

Two formulas for the treatment of man with powders for destruction of lice have been developed by E. F. Knipling and R. C. Bushland at Orlando, Florida. Body lice were maintained in a colony, and research subjects were hired for feeding the lice and for conducting the large number of tests with insecticides. Materials showing promise in jar tests were applied to the inside of the sleeves and legs of underwear, and this portion of the underwear was then taped onto the leg or arm of the research subject. Various stages of lice were introduced into these abbreviated garments, where they remained for 24 hours. At the end of this time the number killed by the treatment was determined. In the case of promising lousicides, new lice were added to the garment each day to determine the period of effectiveness.

In this manner a powder was developed known as MYL. This powder killed lice for one to two weeks, and in most instances a single treatment was sufficient. Ten per cent of DDT in pyrophyllite gave protection for two to three weeks and sometimes longer. This material remained in the clothing long enough to kill the young as they hatched from the eggs; it was therefore not necessary to add an ovicide as was done in the MYL treatment.

These powders have been adopted by the armed forces and have been the means of controlling typhus epidemics in the present war.

7. *Parasites as Factors in Production of Meat and Other Animal Products in Wartime.* BENJAMIN SCHWARTZ, U. S. Bureau of Animal Industry.

The war has increased materially the nation's need of meat, leather, wool, mohair, bristles, feathers, catgut sutures, sausage casings, and other animal products. Because they affect adversely the health of animals, zooparasites interfere materially with the production of meat, fiber, leather, and other products of animal origin, the losses sustained in wartime being difficult to overcome through importations.

Among the most serious offenders are cattle grubs (*Hypoderma lineatum* and *H. bovis*) that spoil one out of three hides by puncturing holes in the skin and causing, moreover, considerable loss of meat. Other arthropod parasites also produce skin injuries that render hosts unthrifty, affect the hair coat, and decrease the value of hides for leather.

Gastrointestinal nematodes produce death losses in young animals, and much unthriftiness, especially in growing stock. One species (*Oesophagostomum columbianum*) spoils sheep intestines for catgut sutures and sausage casings. Liver flukes (*Fasciola hepatica* and *Fascioloides magna*), tapeworm cysts (*Taenia tenuicollis*), and fringed tapeworms (*Thysanosoma actinioides*), spoil ruminant livers for food and medicinal preparations ,and produce other losses.

Research, begun in peacetime and accelerated under the war impact, lead to practical applications of parasite-control measures, especially medication. The principal medications used to bolster production of meat and other animal products are: (1) rotenone to control arthropod parasites of livestock; (2) phenothiazine to control and eradicate nematodes of ruminants, and (3) a hexachlorethane-bentonite suspension, a product of wartime research in the U. S. Department of Agriculture, to control liver flukes of cattle.

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